

REMARKS/ARGUMENTS

Favorable reconsideration of this application as currently amended and in view of the following remarks is respectfully requested.

Claims 1-5 are currently active in this case. Claim 1 has been amended in order to correct the misspelling of the term "pipe" and claim 5 has been added by the current amendment.

In the outstanding Office Action, Claim 1 was rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,670,699 to Mikubo et al. in view of U.S. Patent No. 4,079,410 to Schierz; and Claims 2-4 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Mikubo et al. in view of Schierz and PCT Published Application WO 90/09037.

Applicants acknowledge with appreciation the courtesy of an interview granted to Applicants' representative on August 10, 2005 at which time the outstanding issues regarding the applied art were discussed.

Briefly recapitulating, the present invention (Claim 1) is directed to a semiconductor device including a conductive pipe; a power semiconductor element; and an external connecting terminal including a tip portion bonded onto a plane of the conductive pipe. A mold resin covers the whole surface of the power semiconductor element, the whole of the inner lead part of the external connecting terminal, and the outer surface of the conductive pipe. The conductive pipe serves both as a refrigerant path for cooling the power semiconductor element and as a conducting path for conducting the power semiconductor element and the external connecting terminal. See the specification at page 5 lines 6-11.

Claim 3 is directed to a semiconductor device including an insulative pipe which functions as a refrigerant path; a power semiconductor element; and an external connecting

terminal. The external connecting terminal includes an inner lead part including a pad part bonded onto the plane of the outer surface of the insulated pipe.

The Official Action asserts regarding claim 1 that Mikubo et al. disclose an external connecting terminal 13 including an inner lead including a tip portion bonded onto the plane in the outer surface of a conductive pipe. Applicants respectfully traverse. As discussed during the interview, Applicants respectfully submit that the multilayer wiring layer is not an external connecting terminal including an inner lead part. That is, the multilayer wiring layer 13 requires a bonding wire 30 to connect to the semiconductor element 16. Such a connection requiring a wire 30 is similar to terminal 5 disclosed in Figure 1 of Applicants' specification. However, the external connecting terminal defined by Claim 1 is shown, by way of non-limiting example, as element 6 of Figure 1. As can be seen from Figure 1, the terminal 6 contacts the pipe 7 and because the pipe is conducting, a conducting path for conducting between the power semiconductor element and the external connecting terminal exists.

Regarding the Schierz patent, Schierz states in column 3, lines 47-52 that a wafer or thin plate 100 of a thermally good conducting electrical insulating material is attached to the upper surface of the cooling member 1 so that the cooling member or plate 1 can be used without electrical potential. Consequently, Schierz fails to remedy the deficiencies of Mikubo et al. in that it fails to teach that the pipe functions as a conducting path for conducting the power semiconductor element and an external connecting terminal. Further, Schierz teaches away from such a configuration by teaching that the plate 1 has an upper surface 6 which is configured not to have an electrical potential.

For the foregoing reasons, Mikubo et al. are not believed to anticipate or render obvious the subject matter of the present invention (Claims 1 and 2) when considered alone or in combination with Schierz.

Regarding claims 3 and 4, the official action concedes that Mikubo et al. fail to disclose an insulated pipe. Applicants agree. Further, because the pipe in Mikubo et al. is not an insulated pipe, Applicants submit that the external connecting terminal 13 of Mikubo et al. is not equivalent to the external connecting terminal defined by independent claim 3. Further, the semiconductor element 1 is not fixed to the pad part of the external connecting terminal 13 of Mikubo et al. Rather, interposer 3 is fixed onto the pad 6a. Further, the semiconductor element 16 relied upon on page 7 of the office action is not shown in Figs. 3 and 4. Rather, the semiconductor element 16 shown in Figs. 6 and 7 is merely connected to a layer 13 through a bonding wire 30. Consequently, the semiconductor elements 16 and 1 of Mikubo et al. are not believed correspond to a power semiconductor as defined by the independent claim 3 of the present application.

Regarding Schierz, the cooling member 1 shown in Fig. 3 and relied upon in the office action is a conductor formed of copper or the like, in which regard, the cooling member does not equate to the insulative pipe defined by independent claim 3. Moreover, the member 210 of Schierz is different from the external connecting terminal defined by independent claim 3 in that the structure shown in Fig. 3 of Schierz comprises an insulating disk 100 and a metallization 110. Moreover, Applications point out that the object of Schierz is different from the object and the effect of the subject matter of independent claim 3.

Lastly, the official action asserts that Murase discloses an insulated pipe. Applicants respectfully traverse. Applicants respectfully submit that, in Fig. 1 of Murase, members 1a and 1b of the pipe are metal pipes, and the member for connecting the members 1a and 1b with each other to prevent a short circuit is an insulator 7. In this respect, the assertion in the office action about an insulating film in the abstract is traversed. Moreover, in Fig. 1 of Murase, the semiconductor element 4 is fixed directly on a metal block 3. Further, the metal block 3 is fixed onto the surface of the metal pipe 1b. The metal block 3 is not formed on the

insulator 7. Moreover, in Fig. 4 of Murase, the members 1a and 1b of each pipe 1 are metal pipes, and a member for preventing short circuit by connecting 1a and 1b is an insulating trunk 7. The metal pipe 1b is inserted into a metal block 3, and the semiconductor element 4 is merely fixed onto the surface of the metal block 3. Thus, in Fig. 4 of Murase, the metal block 3 is not formed on the insulating trunk 7. Therefore, the structures shown in Figs. 1, 2 or 4 of Murase do not disclose or suggest the features defined by independent claim 3.

For the foregoing reasons, the combination of Mikubo et al., Schierz, and Murase is not believed to render obvious the subject matter defined by independent claim 3.

Consequently, no further issues are believed to be outstanding in the present application and the application is believed to be in condition for allowance. An early and favorable action is therefore respectfully requested.

Respectfully submitted,

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